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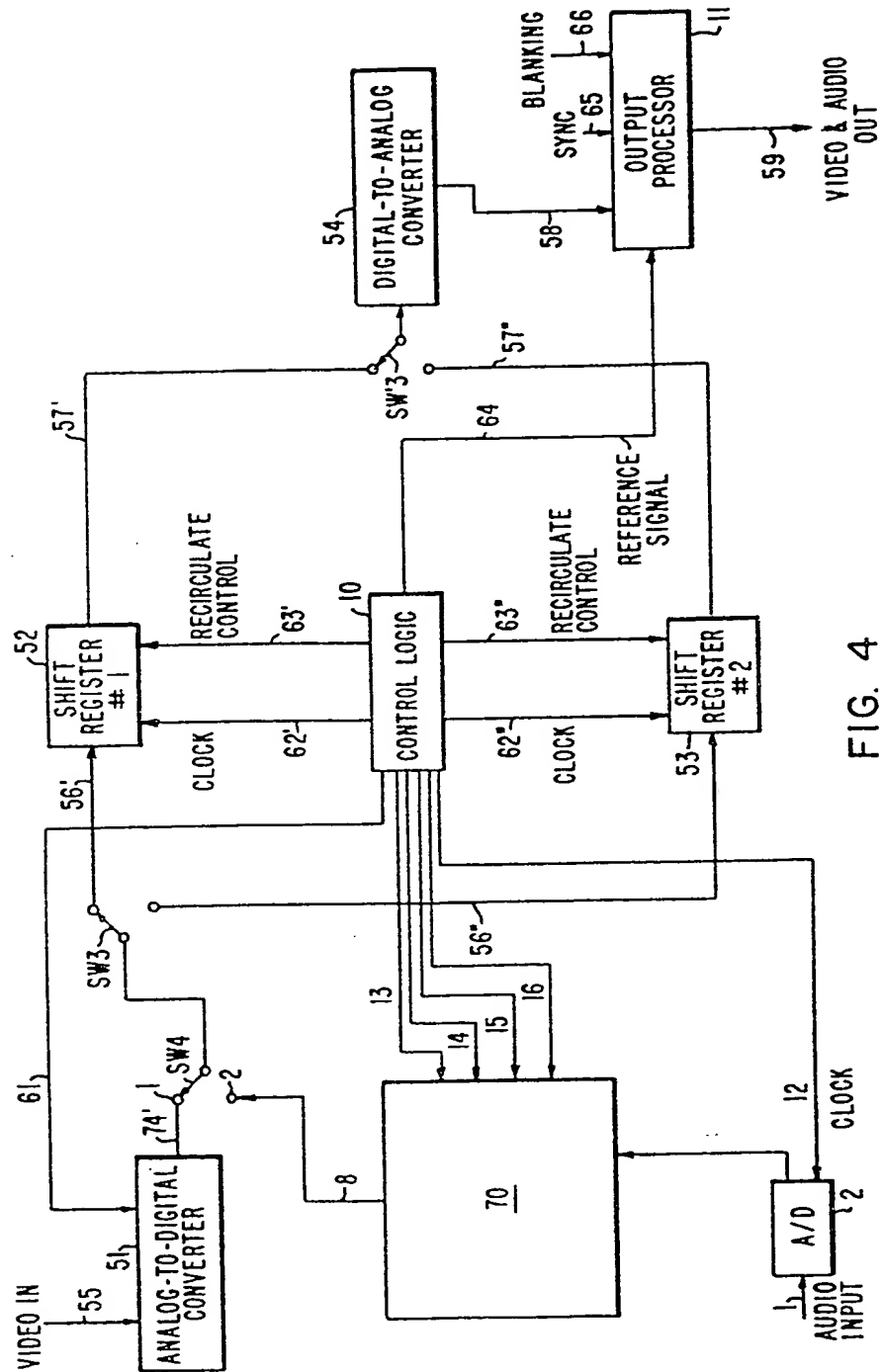
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(54) A scrambling and unscrambling system for television sound signals.

(57) An audio scrambler (70) operates on segments of audio divided from a continuous audio signal to rotate head-to-tail at M1 and M2 the string of information contained in the segment by an amount which is at pseudo-random between the successive segments. When the segments are compressed at 6 and 7 to video format, the scrambled compressed audio signals are inserted into an unused line of the vertical blanking space of a television system for transmission with the video signals. The inserted audio is combined with decoy signals, also in the vertical blanking space to increase security of transmission. Concurrent scrambling of compressed audio signals and video signals is provided.

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A SCRAMBLING AND UNSCRAMBLING SYSTEM
FOR TELEVISION SOUND SIGNALS

This invention relates to an improved scrambling and unscrambling system for television sound signals.

Signal scrambling techniques are known in audio as well as in video systems for the purpose of preventing unauthorized hearing or viewing. In contrast to a cryptographic security system, a scrambler system does not necessarily provide total privacy in the communication. It does not insure that the message will not be unscrambled by somebody determined to do it. At least scrambling will make it difficult, or costly, for someone to reconstitute the scrambled message without the knowledge of the code.

The present invention adapts for audio scrambling a technique which has been disclosed in a television system for video scrambling. The technique is found in U.S. Patent No. 4,070,693 issued January 24, 1978 to Harold B. Shutterly. While the scrambling method in the patent is applied exclusively to a television video signal, it affords several advantages when, as proposed by the present invention, it is adapted for audio scrambling in general, and more particularly, used for transmitting the audio on the video channels of a television system.

It is known in the prior art to concurrently scramble the audio and the video signals of a television system. See for instance U. S. Patent No. 3,919,462 of A. Hartung et al., No. 3,852,519 of Patrick R. J. Court and No. 3,736,369 of Joseph H. Vogelmann et al.

It is known from U.S. Patent No. 3,872,503 of H. B. Shutterly, to divide a continuous signal into successive segments, or samples and with these to generate time-compressed audio signals in the video format which
5 can be accommodated with true video signals for concurrent use, e.g. for transmission in a television system. Discontinuities and unwanted transients at the junction between segments are eliminated from the constructed
10 signal by adding repeated portions of the segment, or sample, at the ends thereof.

It is known from U.S. Patent No. 3,789,137 of George F. Newell to time-compress segments of an audio signal to convert them into video format for recording, or transmission. Analog-to-digital conversion and digital to
15 analog conversion at both ends of the conversion scheme are used with two registers for alternately processing in digital form successive segments divided from the original continuous audio signal.

It is known from U.S. Patent No. 3,731,197 of J.E. Clark to divide a continuous audio signal into successive segments which are sampled for storage and scrambling in accordance with a code before transmission. The
20 same code at the receiving end allows reconstruction of the segments and continuous reproduction of the audio signal.
25

It is known from U.S. Patent No. 3,824,467 of R. C. French, or U.S. Patent No. 3,970,790 of G. Guanella, to divide an audio signal into segments and to rearrange such segments so as to form an unintelligible transmitted
30 signal.

It is known from U.S. Patent No. 3,925,612 of G. Guanella, et al. to scramble a polarity modulated message pulse series with a shift register which is scrambled cyclically, scrambling being obtained by output feed back
35 into selected locations of the shift register.

It is known from U.S. Patent No. 3,819,852 of Peter Wolf to store the audio in time-compressed form during the period of a line in the vertical blanking

interval subsequently to the video signal.

It is an object of this invention to provide an improved scrambling and unscrambling system for television audio signals with a view to overcoming the deficiencies of the prior art.

The invention resides in a scrambling and unscrambling system for television audio signals, for use in a television system having a transmitter, a receiver and a communication channel, the scrambling portion of said system comprising means for dividing said continuous audio signal into consecutive audio segments of a predetermined length; characterized in that said scrambling system further includes first means for cyclically rotating each of said divided segments in accordance with a pseudo-random pattern to derive rotated audio segments; second means for compressing each of said rotated audio segments down to the length of a video line of said television system; and third means responsive to the vertical blanking pulse of said television system for inserting each of said compressed audio segments as a video line into a corresponding one of the vertical blanking spaces separating the active video lines of said television system.

When dividing a continuous audio signal into segments in order to scramble the divided segments for transmission and unscrambling when received, the effectiveness of the method depends upon the size of each segment, since the more information there is contained in one segment, the more effect will scrambling have on the transmitted message.

It is proposed to divide a continuous audio signal into segments having a substantial length in order to maximize the information contained in each segment within the constraint of the transmission and reception process. Thereafter, each audio segment is submitted to a scrambling process such as described for video signals in U.S. Patent No. 4,070,693 of H. B. Shutterly.

The method is completed at the receiver end by a reverse process consisting in deriving separately each

received audio signal, reconstructing audio segments and combining segments to form a continuous audio signal as a faithful representation of the original continuous audio signal.

5 The invention also provides for cascade scrambling in two stages, by adding a second scrambling stage operative on both the already scrambled samples in video format and the video signals, like in U.S. Patent No. 4,070,693.

10 The object of the present invention can be implemented with several modifications. Thus, the inserted audio can be transmitted by the television system from video frame to video frame or from video field to video field.

15 Increased secrecy is achieved by inserting the scrambled and compressed audio signal in any of the lines available in the vertical blanking space, together with decoy signals, the line selected for the audio signal being varied in a pseudo-random fashion throughout the successive video fields, or frames.

20 The invention will become readily apparent from the following description of exemplary embodiments thereof when taken in conjunction with the accompanying drawings, in which:

25 Figure 1 is a diagrammatic representation of the overall scheme used for scrambling an audio signal and transmitting the scrambled audio signal together with the video signal of a video system.

30 Figure 2 shows a video scrambler of the prior art.

 Figure 3 shows the video lines outputted by the transmitter and video scrambler according to Figure 2.

 Figure 4 is the video scrambler of Figure 2 embodying the audio scrambler at the transmitter side.

35 Figure 5 is the audio unscrambler at the receiver side.

 Figure 1 shows in block diagram form the overall scheme used for scrambling an audio signal and trans-

mitting it in video format together with the video signals of a video system. The video mixer 11 has associated to it a control logic 10 and an audio signal processing channel controlled by the control logic. The audio signal processing channel includes an analog-to-digital converter 2 responsive to a continuous audio signal inputted on line 1. Two memory devices 3, 4, each in the form of a RAM (random access memory) device are respectively and alternately switched to the output of A/D converter 2 and to an output line 5 by the logic of circuit 10, as symbolized by switches SW_1 , SW'_1 . When switch SW_1 connects A/D converter 2 to the input of device 3, switch SW'_1 connects the output of device 4 to line 5, as shown on Figure 1, and conversely. A clock signal on line 12 from circuit 10 establishes a sampling rate for A/D converter 2, thereby to convert the audio input into successive digital samples, each defining in binary form the magnitude of the audio input signal as sampled. These samples are successively stored into the locations of RAM device 3 by the effect of a Write address control signal coming via line 13 from logic circuit 10, and going to line 13' of device 3. In the meantime, logic circuit 10 controls, via lines 14 and 14", the Read process of the other RAM device 4, whereby the samples from the successive locations are being passed by switch SW'_1 onto line 5. The switching frequency of switches SW_1 , SW'_1 is a function of the sampling rate of A/D converter 2 and of the number of locations in the RAM devices. Memories M_1 , M_2 provide segments divided from the input analog audio signal when devices 3 and 4 are being alternately operated upon. These segments are chosen to be of sufficient duration to bear substantial message information. The sampling rate typically is selected to be 14.4 KHz on line 12. Also, typically, RAM devices 3 and 4 have each 4096 locations by manufacturer's design. With a sampling frequency of 14.4 KHz and 8-bits per sample, there can be stored 3840 amplitudes for a total duration of 267 milliseconds, which duration is defined by the alternate rate of SW_1 , SW'_1 . 267 milli-

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seconds is also the effective duration of the audio segments in such instance. Control logic circuit 10 applies to the reading process of alternate RAM devices 3, 4 the pseudo-random technique of Shutterly Patent No. 4,070,693 defined as a cyclical rotation head to tail of the entire string of stored samples. The Read address is on line 14' for device 3, on line 14" for device 4. The address is given in binary form according to a pseudo-random pattern, e.g. one location is selected at pseudo-random as the initial location for cyclical scanning of the device being read-out. All the other locations of the device are thereafter scanned cyclically in successive order. Therefore, the reading process in fact effects a rotation of the entire sequence of samples initially stored e.g. by 13' or 13", into device 3, or 4. Such scrambling method of a series of orderly samples distinguishes itself over the prior art method consisting in changing the relative positions of many samples, like in U.S. Patent No. 3,970,790 of S. Guanella. As already mentioned, the audio scrambling technique applied to devices 3 and 4 is like in U.S. Patent No. 4,070,693 of Shutterly.

Thus, on line 5 scrambled segments are being passed from either device 3, or device 4, which digitally correspond to an audio segment. Such scrambled segments are further processed in the processing channel by compressor devices 6 and 7 which are alternately controlled by logic circuit 10, as symbolized by switches SW_2 , SW'_2 , one at the input, the other at the output of the compressor device. The digital bits are first being stored into device 6 or 7, depending upon the position of switch SW_2 . While storing is at the clock rate of the samples, e.g. 14.4 KHz in the example, data from device 6, or 7 is read-out at a much higher speed, typically at 5.12 MHz in the example, e.g. under the effect of a Read address applied via lines 16 and 16' or 16 and 16", depending upon whether the position of SW'_2 is toward device 6, or device 7. With 240 samples being read-out from one device at a 5.12 MHz rate, the samples are outputted on line 8 in a

time span of $50 \mu s$, e.g. within the standard video-line format. Conversion into analog form by D/A converter 8 permits, with filtering if necessary, the recovery of an audio signal in compressed form.

5 The video mixer 11 is receiving on line 19 composite video signals of the video system, which may, or may not, have to be scrambled in accordance with the Shutterly Patent No. 4,070,693. To mixer 11 are also applied the compressed and scrambled audio packs via line 10 17. While there is $1/60$ of a second between successive fields of the video system, assuming a 525 lines standard video system, there are actually 262.5 lines available during such $1/60$ of a second interval, 240 of which are visible and 22.5 more lines which are not used for video 15 and left unoccupied in the vertical blanking space between visible frames. While deriving on line 5 one segment from device M_1 or M_2 , the data are shifted by SW'_2 at a rate of $1/60$ second from compressor #1 onto compressor #2, and conversely. Therefore, SW_2 and SW'_2 in fact derive suc- 20 cessive groups of 240 samples which are read at a rate of 5.12 MHz, that is in $48 \mu s$ for conversion to video format.

At some instant (once during each interval of $1/60$ second (as defined by switches SW_2 , SW'_2) logic circuit 10 inserts the compressed audio signal, which is 25 $48 \mu s$ long, into line 22, together with the composite video signals derived on line 19, so that when transmitted by mixer 11 it will be inserted into one of the lines available in the vertical blanking space between video fields.

30 The audio scrambler system according to the invention is used preferably with a scrambling video system such as disclosed in U.S. Patent No. 4,070,693 of Shutterly. For the purpose of the description hereinafter of the preferred embodiment of the invention, the Shut- 35 terly patent is hereby incorporated by reference. The Shutterly video scrambler is shown in block diagram in Figure 2.

The analog video signal received on line 55 is

converted into a sequence of binary numbers by analog-to-digital converter 51, which is clocked via line 61 by control logic circuit 50. Initially, the binary numbers representing the first active video line are clocked, via
5 switch SW_3 in position #1 and line 56', into a first shift register 52. At the end of video line #1, switches SW_3 , SW'_3 are thrown by logic circuit 50 into respective positions #2 and #1. Now, the video line #2 is clocked by logic 50 via line 61 (controlling A/D converter 51) and
10 via line 62", into a second shift register 53 through switch SW_3 and line 56". Meanwhile, the binary numbers stored in shift register 52 for video line #1 are recirculated through a controlled number of shifts determined by circuit 50, via line 63' and read-out in this order via
15 SW'_3 in the first position. As shown in Figure 3, at this moment video line #1 is occurring at the output. Now, video line #3 is admitted via line 56' into shift register 52, while the recirculated video line #2 has its binary numbers (stored in shift register 53) being recirculated
20 through another controlled number of shifts determined by circuit 50, via line 63" and outputted via lines 57" and SW'_2 in the second position. Next, video line #4 is admitted into shift register 53 with switch SW_3 in the second position, while recirculated video line #3 emerges
25 on line 57 through switch SW'_3 in the first position. These steps repeat themselves ad infinitum so that the successive video lines #1, #2, #3, etc. are in fact inputted into digital-to-analog converter 54 in scrambled form. The successive numbers of shifts controlled by
30 lines 63' and 63" from logic circuit 50, follow a predetermined pseudo-random pattern, which will be used at the receiver station for sampling by the same reverse process in reverse. From D/A converter 54, the scrambled video signals are processed for transmission by an output
35 processor 11 in relation to a signal received on line 65 and a blanking pulse, on line 66, as generally known with television systems. The outputted video lines appear successively on line 54 in the order required for ulterior

field scanning and frame build-up at 1/60 of a second between blanking pulses and with a total of 525 lines per frame as in a standard television system.

5 Figure 3 shows the signal waveform that would result from applying this processing to a sawtooth video signal. As explained from processing the initial video lines #1 and #2, and as shown in Figure 3, the transmitted video signal on line 59 is delayed by one period relative to the inputted video signal of line 55.

10 As shown in Figure 4, the video scrambling system of the Shutterly patent can be modified to introduce concurrent audio scrambling. This can be implemented by adding a second scrambling stage following the stage shown by Figure 1. This is achieved at minimum cost
15 because the audio scrambling channel uses a large portion of the video scrambling portion which is already installed, including the pseudo-random number generator and the shift register for recirculation of either the video line signals, or the audio signals, after they have been
20 given the same format. As shown in Figure 4, the transmitter includes a first scrambling stage which operates on the audio segments like the portion of circuitry identified by block 70 in Figure 1. The transmitter further includes a second scrambling stage applied to the already
25 scrambled audio of line 8 when the insertion into the vertical blanking space is required, and in concurrence with a video line to the video signals as they occur on line 55. The pseudo-random number generator is part of the control logic circuit 10. This is a generally known
30 technique. One technique to achieve a pseudo-random number sequence pattern is disclosed in Shutterly Patent No. 4,070,693. A similar circuit arrangement controlled in the recirculating mode by an identical pseudo-random number generator, is used at the receiver. When the shift
35 register recirculations have been made the complement of those of the transmitter shift register, it is apparent that the video signal is restored to its original form. The reference signal on line 64 from logic circuit 50 is

used as a synchronizing code added to the transmitted video signals to make the pseudo-random generator of the receiver synchronous with the one of the transmitter. Signal processing is fully disclosed in the Shutterly patent which has been incorporated by reference.

Referring to Figure 4, in operation, the scrambled signal in digital form of line 8 is supplied to the second position contact of switch SW_4 . Switch SW_4 symbolizes control by logic circuit 10 in such a way that for switch position #1 the video signals from A/D converter 51 are derived between field blanking pulses. When the field blanking period occurs, switch SW_4 is being thrown into position #2 and audio data from line 8 are transferred onto line 56' or 56", according to the position of switch SW_3 at the moment. Thus, segments of the audio signal 1/60 second in duration are passed in compressed form between video lines of two successive fields. Once the audio signal has been stored in shift register 52, or 53, it is scrambled once more by recirculation. When switch SW_4 is on position #1, recirculation is applied in the same fashion to the video signals from line 74'. Recirculation is performed under control of logic circuit 10 via line 63' or 63" onto shift registers 52 or 53. The output processor 11 transmits via line 59, the compressed and scrambled audio signal after digital-to-analog reconversion by converter 54 which is also used for the video signals since they both are in video format. Thus, transmission of the audio signal occurs in accordance with control by line 64 from circuit 10 within the blanking space defined between video lines of two successive fields.

Many possible variations are within the scope of the present invention. Typically, the number of samples required to transmit an audio signal 1/60 second long of high quality, is approximately 500. The number of samples required to transmit one line of a color television signal faithfully is close to 1000. Compatibility is achieved with the following options. The audio signal may be

sampled at the higher rate so as to produce the same number of samples per field, as there are in one line of video signal. Otherwise, only one line of compressed audio per frame shall be used, instead of one line per field, thus, accepting a somewhat reduced quality of reproduction. When the higher audio sampling rate is adopted, an auxiliary storing device is required in order to hold the samples generated while shift register is being emptied at high speed for one line period. Simultaneously, at the receiver, an auxiliary storing device will be used.

The compressed audio signal lends itself to several schemes which will provide a higher security than mere scrambling by shift registers 52 and 53. This comes from the fact that in a standard 525-lines television system, during the vertical blanking period there are ten or eleven lines available for data transmission, namely for a 525 standard lines standard, there are 262.5 lines per field, of which only 240-242 are truly visible and nine which are used in the blanking space for synchronization information. Each of these eleven lines are thus capable of carrying an audio signal. If one line is used for transmitting the audio signal, it is possible to add some meaningless audio signals and place them in the other lines, thus, increasing the security of the transmission. Such additional audio signals are being retrieved when reconstructing the audio message at the receiver end. The additional, or decoy signals could be scrambled with the true ones at the transmitter end, unscrambled at the receiver end, then, sorted out. It is also contemplated to distribute the eleven decoy signals and true audio signal on a pseudo-random basis from field to field, thereby to achieve with a scrambling system a high degree of security.

Figure 5 shows the audio/video scrambler of the preferred embodiment at the receiver side. The video and audio signals received on line 81 are passed into an A/D converter 82 controlled by the control logic circuit 90 of

the receiver, on line 92. The sampled numbers are alternately stored into shift register 85, or shift register 86, when control logic circuit 90 sets the entry switch SW_5 into position #1 (input line 84'), or into position #2 (input line 84"). The shift registers are clocked by lines 87', 87", respectively for entry of the binary segments of a video, or an audio signal. In a pseudo-random fashion which is complementary of the scrambling process at the transmitter, the contents of the shift registers are alternately recirculated under control of logic circuit 90 by line 88', or 88". The unscrambled signals are then transferred via lines 91' or 91" and switch SW_6 to one of two possible output channels which correspond to the two audio and video inputs of the transmitter, respectively. The video lines are immediately converted into analog form by D/A converter 98 and reconstruction of the image ensues through an output processor 99 responsive to the video line signals in line 101, the sync signal on line 104 and the blanking pulse on line 105. The outputted video is fed to the receiver's display tube by line 106.

The audio portion, on line 94, is fed into a shift register 96 for decompression into the original 1/60 of a second format and conversion into analog is effected by a low speed D/A converter 97. At the output, on line 103, appears a continuous audio signal which can be filtered if need be. Thus, the reverse process of the video and audio signals is a straight forward adaption from signal processing at the transmitter side.

There are many ways of implementing digital treatment of the signals for scrambling and/or for compressing. Solid state technology, and logic circuitry in hardware or software can be used wherever indicated. For instance the storing devices of Figure 1 have been shown as RAM devices which are addressed by the control logic circuit, whereas shift registers have been shown in Figures 2, 4, and 5. It is understood that these are two equivalent means from which to choose for storing and

recirculating the stored data in a pseudo-random fashion, thus to perform a "cyclical rotation" of a string of stored samples head-to-tail, thereby to effect or scrambling as explained in the aforementioned Shutterly patent.

IDENTIFICATION OF REFERENCE NUMERALS USED IN THE DRAWINGS

	<u>LEGEND</u>	<u>REF. NO.</u>	<u>FIGURE</u>
	A/D	2	1
	A/D	2	4
5	M1	3	1
	M2	4	1
	COMPRESSOR #1	6	1
	COMPRESSOR #2	7	1
	D/A	9	1
10	CONTROL LOGIC	10	1
	CONTROL LOGIC	10	4
	MIXER	11	1
	OUTPUT PROCESSOR	11	2
	OUTPUT PROCESSOR	11	4
15	CONTROL LOGIC & PSEUDO RANDOM NUMBER GENERATOR	50	2
	ANALOG-TO-DIGITAL CONVERTER	51	2
	ANALOG-TO-DIGITAL CONVERTER	51	4
	SHIFT REGISTER #1	52	2
20	SHIFT REGISTER #1	52	4
	SHIFT REGISTER #2	53	2
	SHIFT REGISTER #2	53	4
	DIGITAL-TO-ANALOG CONVERTER	54	2
	DIGITAL-TO-ANALOG CONVERTER	54	4
25	ANALOG-TO-DIGITAL CONVERTER	82	5
	SHIFT REGISTER #1	85	5
	SHIFT REGISTER #2	86	5
	CONTROL LOGIC	90	5
	SHIFT REGISTER #3	96	5
30	SLOW-SPEED DIGITAL-TO-ANALOG CONVERTER	97	5
	DIGITAL-TO-ANALOG CONVERTER	98	5
	OUTPUT PROCESSOR	99	5

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What we claim is:

1. A scrambling and unscrambling system for television audio signals, for use in a television system having a transmitter, a receiver and a communication channel, the scrambling portion of said system comprising
5 means for dividing said continuous audio signal into consecutive audio segments of a predetermined length; characterized in that said scrambling system further includes first means for cyclically rotating each of said divided segments in accordance with a pseudo-random pat-
10 tern to derive rotated audio segments; second means for compressing each of said rotated audio segments down to the length of a video line of said television system; and third means responsive to the vertical blanking pulse of said television system for inserting each of said com-
15 pressed audio segments as a video line into a corresponding one of the vertical blanking spaces separating the active video lines of said television system.

2. The scrambling and unscrambling system of claim 1 with the unscrambler portion of the system
20 comprising fourth means responsive to the vertical blanking pulse of said television system for deriving an inserted compressed audio signal from the associated vertical blanking space; fifth means for decompressing said compressed audio signal up to said predetermined length;
25 characterized by the provision of sixth means for rotating back said decompressed audio signal with the same pseudo-random pattern in reverse to form an audio segment which is a faithful representation of the original; and

seventh means for outputting consecutive audio segments to form a continuous audio signal which is a faithful representation of the original.

5 3. The scrambling and unscrambling system of claim 2, characterized in that said first means includes first and second memory means operative in a Write and Read mode, one of said first and second memory means being operative with an audio segment of even order, the other of said first and second memory means being operative with
10 an audio segment of odd order.

 4. The scrambling and unscrambling system of claim 1 or 3, characterized in that analog-to-digital converter means is provided to convert said continuous audio signal to digital form before inputting into said
15 first and second memory means.

 5. The scrambling and unscrambling system of claim 4, characterized in that said first and second memory means are alternately scanned in the Read mode to store digital data from respective consecutive audio
20 segments sequentially, and are read out in the Read mode, alternately, from an initial location defined by said pseudo-random pattern for successive audio segments.

 6. The scrambling and unscrambling system of claim 4, characterized in that digital data from respective consecutive audio segments is circulated in sequential
25 order through said first and second memory means, alternately, in the Write mode, and with the stored digital data being recirculated in the Read mode to derive data from one location selected in accordance with said
30 pseudo-random pattern for successive audio segments.

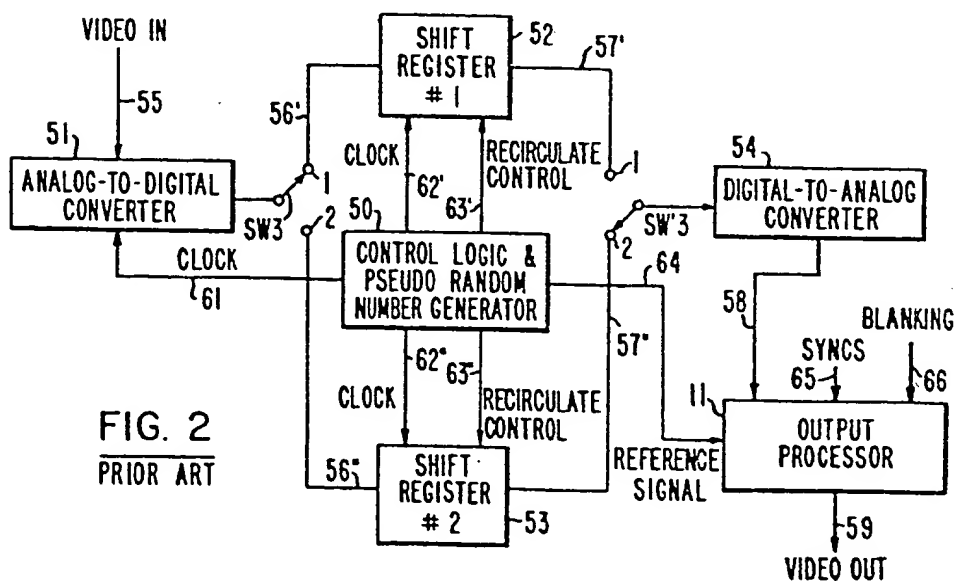
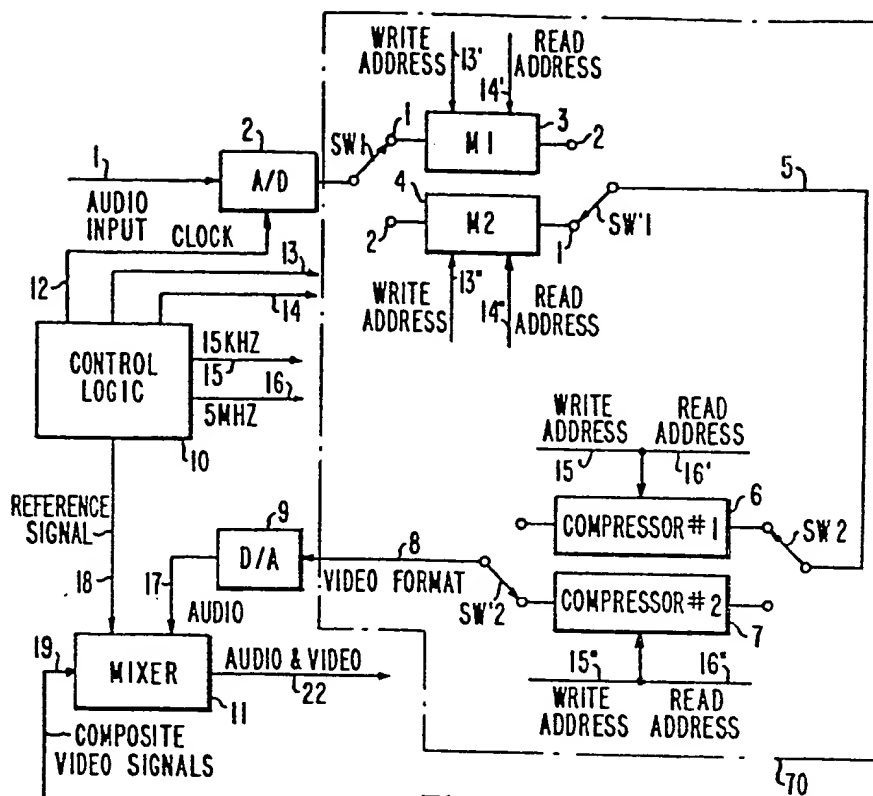
 7. The scrambling and unscrambling system of claim 3 characterized in that a control logic provided for switching said first and second memory means at a rate defining audio segments of said predetermined length.

35 8. The scrambling and unscrambling system of claim 7, characterized in that said second means includes third and fourth memory means alternately responsive to said first and second memory means, said third and fourth

memory means being switched at the television field rate for deriving a succession of groups of samples from the associated segment in one of said first and second memory means, said third and fourth means being read-out at a rate to compress each of said groups within a video line format for insertion.

5
10 9. The scrambling and unscrambling system of claim 1, characterized in that decoy signals are respectively inserted into unused video lines within each of said vertical blanking spaces.

15 10. The scrambling and unscrambling system of claim 9, characterized in that the successive said inserted compressed audio segments and associated decoy signals being distributed in a pseudo-random fashion between such unused video lines of the respective vertical blanking spaces of the television system.

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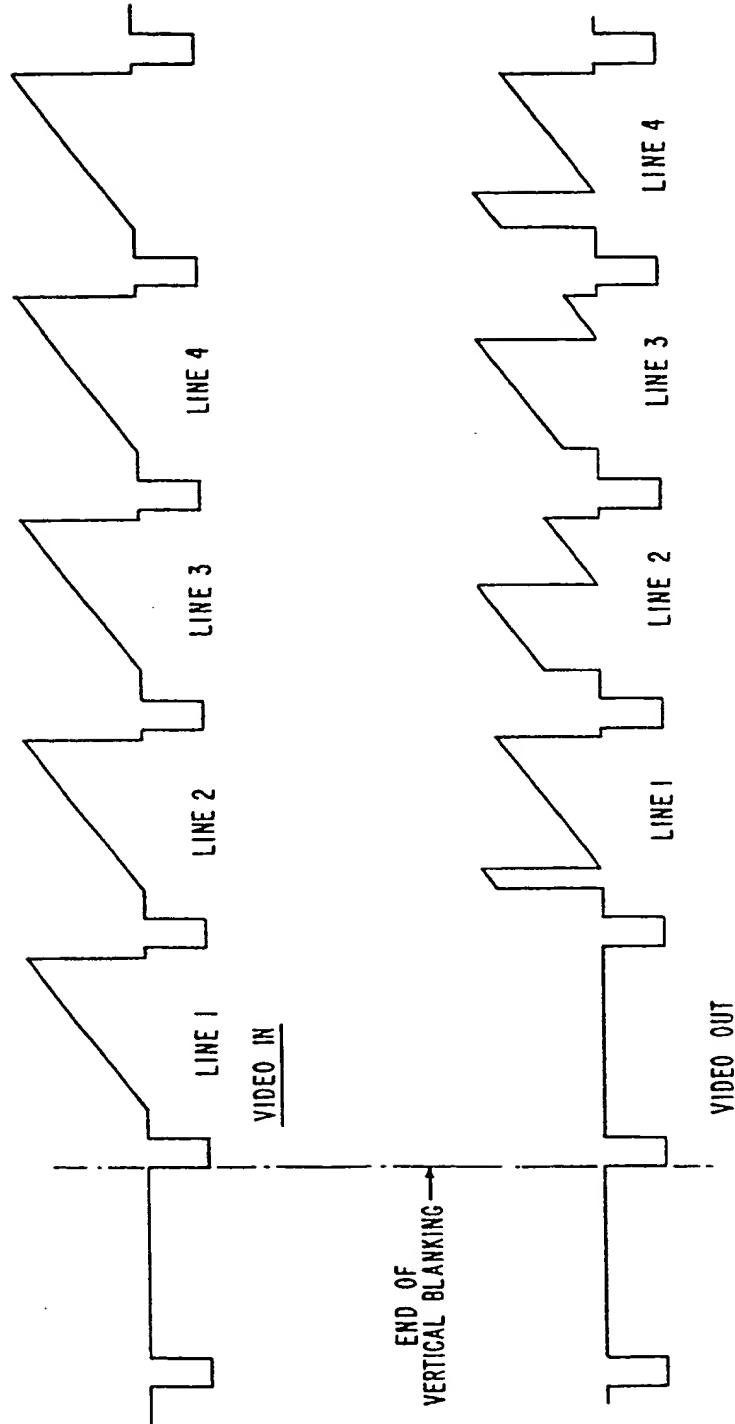


FIG. 3

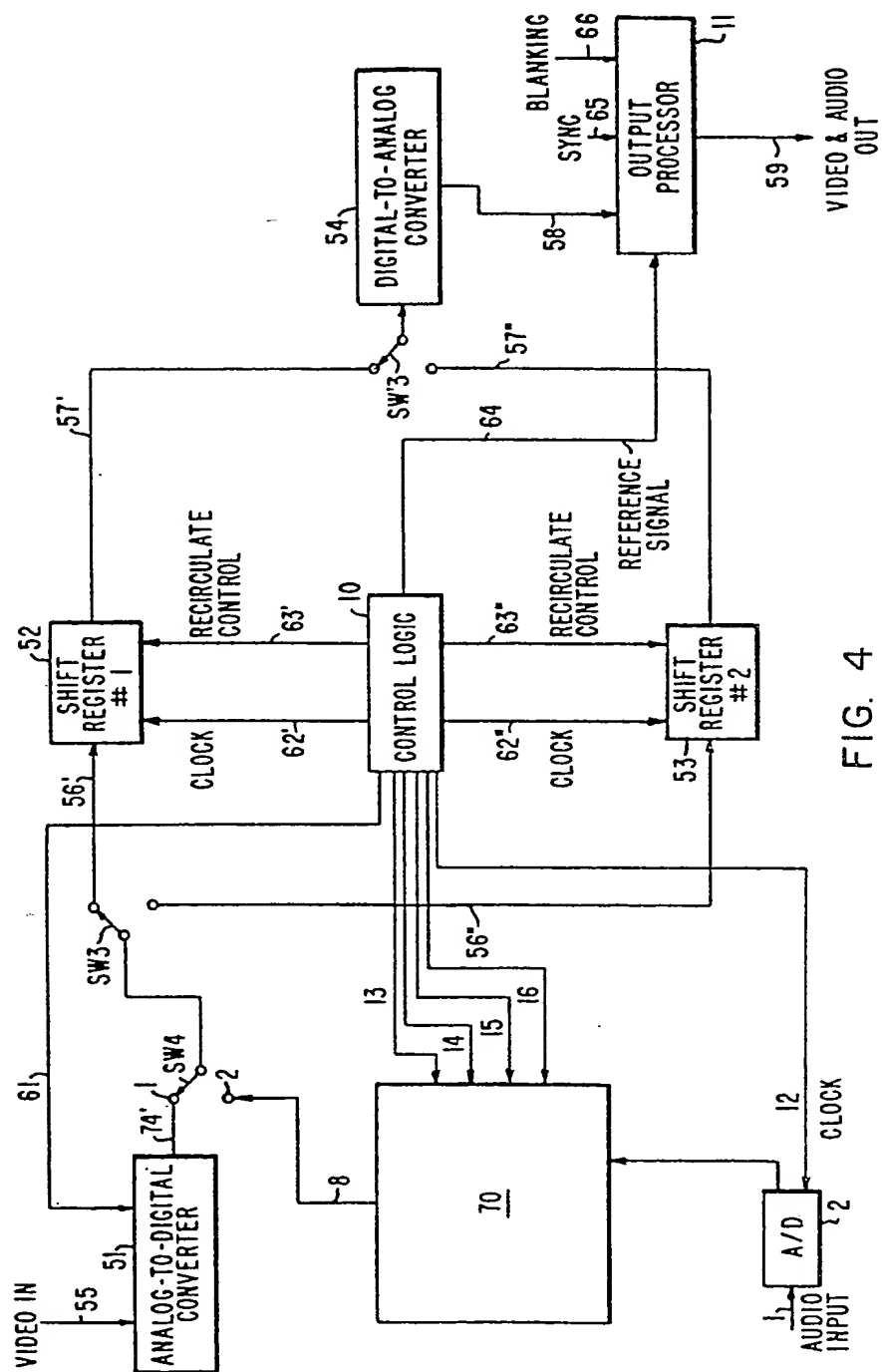


FIG. 4

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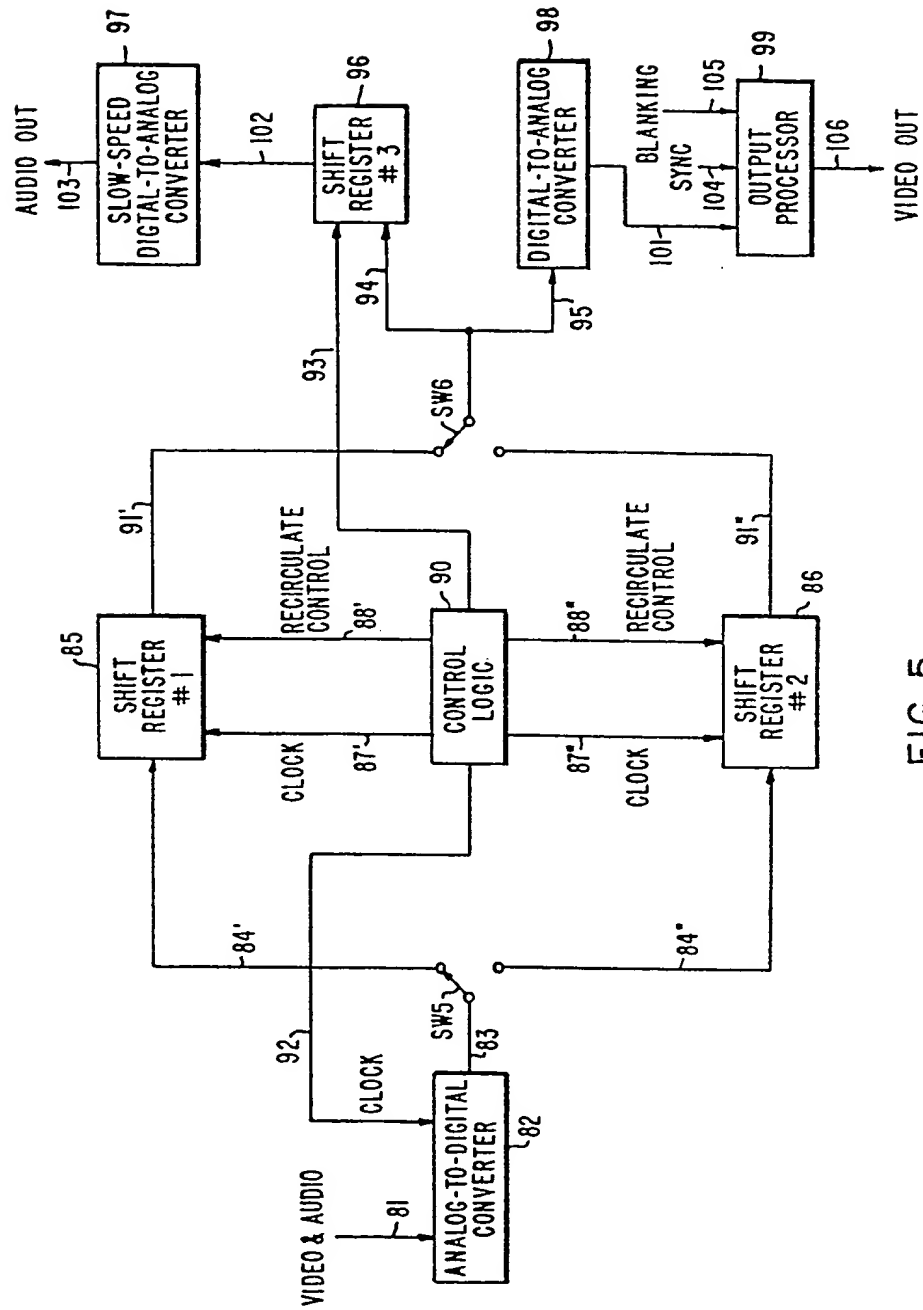


FIG. 5



European Patent
Office

EUROPEAN SEARCH REPORT

0018783
Application number
EP 80 30 1333

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A, D	RADIO MENTOR ELECTRONIC, vol. 37, nr. 2, February 1971 MUNICH (DE) P. WOLF: "Die Übertragung von Sprachen oder anderen Niederfrequenzsignalen in einer einzelnen Zeile der Bildaustastlücke", pages 70 and 72 * Page 70 completely and page 72, left-hand column, lines 1 to 13 * --	1, 2, 4	
	US - A - 4 070 693 (SHUTTERLY) * Column 3, line 23 to column 6, line 50 * --		
A	DE - A - 1 955 710 (STANDARD ELECTRIC LORENZ AG) * Page 2, lines 1 to 26 * --	2	
A, D	US - A - 3 819 852 (WOLF) * Abstract * --	2	
A, D	US - A - 3 789 137 (NEWELL) * Column 3, line 61 to column 7, line 38; column 10, line 38 to column 11, line 2 * --	4	
A, D	US - A - 3 731 197 (CLARK) * Abstract * --		
./...			
<input checked="" type="checkbox"/> The present search report has been drawn up for all claims			H 04 N 7/16 TECHNICAL FIELDS SEARCHED (Int. Cl. 3) H 04 N 7/16 7/04 CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons &: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	11-08-1980	VERSCHULDEN	

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EP 80 30 1333

- 2 -

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
P	<p>FR - A - 2 431 809 (TELEDIFFUSION DE FRANCE)</p> <p>* Page 5, line 29 to page 8, line 10; page 12, lines 14 to 18 *</p> <p>-----</p>	1,3,4,5	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
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- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
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